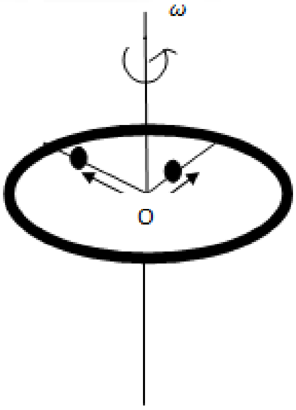
12. A ring of mass M and radius R is rotating with angular speed ω about a fixed vertical axis passing through its centre O with two point masses each of mass $\frac{M}{8}$ at rest at O. These masses can move radially outwards along two massless rods fixed on the ring as shown in the figure. At some instant the angular speed of the system is $\frac{8}{9}\omega$ and one of the masses is at a distance of $\frac{3}{5}R$ from O. At this instant the distance of the other mass from O is

(A) $\frac{2}{3}R$ (B) $\frac{1}{3}R$ (C) $\frac{3}{5}R$ (D) $\frac{4}{5}R$



Answer: Initial angular momentum = $mR^2\omega \rightarrow$ (1) [$Since\ both\ the\ point\ masses\ was\ at\ O$]

After roration angular velocity =$\frac{8}{9}\omega$

Moment of inertia of Ring= mR^2

Moment of inertia of point mass which is at a distance $\frac{3}{5}R = m \times \frac{9}{25}R^2$

Let the other point mass be at a distance $x\ then\ M.I\ of\ the\ point\ mass = m \times x^2$

M.I of the system once rotated= $\big(mR^2 +$ $925mR2+mx2$

Angular momentum of the system =$\left(mR^2 + \frac{9}{25}mR^2 + mx^2\right)\frac{8}{9}\omega \rightarrow (2)$

Applying conservation of angular momentum from equation (1) and (2) we get

$$mR^2\omega = \left(mR^2 + \frac{9}{25}\frac{M}{8}R^2 + \frac{M}{8}x^2\right)\frac{8}{9}\omega\ or\ \frac{1}{8}x^2 = \frac{9}{8}R^2 - R^2 - \frac{9}{200}R^2\ or\ \frac{1}{8}x^2 = \frac{25-9}{200}R^2$$

$$\frac{1}{8}x^2 = \frac{16}{200}R^2\ or\ x^2 = \frac{16}{25}R^2\ or\ x = \frac{4}{5}R$$

Correct option is (D) $\frac{4}{5}R$